1. Given the matrices A and B of sizes m x l and l x n respectively.

a) Write the pseudocode to compute the matrix C = A x B
b) What is the complexity of the code that you wrote?

a) For $i \leftarrow 0$ to m do

For $j \leftarrow 0$ to n do

$C[i,j] = A[i,1] * B[1,j]$

return C

b) 1st Line $m+1$

2nd Line $m(n+1)$

3rd Line $m(n)$

4rd Line 1

$$T(n) = m+1+mn+m+mn+1$$
$$= 2mn+2m+2 = 2(mn+m+1)$$
$$= mn+m+1$$

$O(mn)$

2. Consider the following code fragment,

x ←1
for i ← 1 ..n step 3 do
x ←x +2
print x

$$X = 1 + \sum_{i=1}^{\frac{n}{3}} 2 = 1 + \left\lfloor \frac{n}{3} \right\rfloor \cdot 2$$

3. Consider the following code fragment,

x ←5
i ←1
While (2 i < N) do
i ←i +2;
x ←x +3;

print x

$$5 + \sum_{i=1}^{n} 2i + 3^i = 5 + n^2 + n + \frac{3}{2}(3^n - 1)$$

4. Show that 6n + 3n log(n^5) = O(n logn). Find the appropriate values of C and n_0 .

$$6n + 3n\log(n^5) \leq cg(n) \quad : n \geq n_0$$

$$6n + 15n\log(n) \leq 21n\log n \quad n \geq 2$$

$$C = 21, \quad n_0 = 2$$

5. Show that $2n^3 - 10n^2 + 2 = O(n^3)$. Find the appropriate values of C and n_0.

$2n^3 - 10n^2 + 2 \leq 14n^3 \quad n \geq 1$

$C = 14 \quad n_0 = 1$

6. Prove or disprove the statement, $2^{n+2} = O(n^2)$.

the statment is false

because: $\forall n \geq 1 \Rightarrow 2^{n+2}$ it will always bigger than n^2

$2^n \cdot 2^2 \leq C n^2$

$\frac{2^n \cdot 4}{n^2} \leq C$

7. Prove that $3^n = O(n!)$. Find the appropriate values of C and n_0.

$3^n \leq cg(n)$

$\leq 5(n \cdot n-1 \cdot \dots \cdot 2 \cdot 1) \quad n \geq 1$

$\leq 5 \, n! \quad n \geq 1$

$C = 5 \quad n_0 = 1$

8. Compare the order of growth for 3^{2n} and 5^n.

$3^{2n} \leq c \, 5^n \quad n \geq n_0$

if we set $c = 81 \quad n_0 = 1$ then

$3^{2n} = 81(5^n) \quad n \geq 1$